NOISE AND VIBRATION

Testimony of Shahab Khoshmashrab

SUMMARY OF CONCLUSIONS

The Hidden Hills Solar Electric Generating System (HHSEGS), if built and operated in conformance with the proposed conditions of certification below, would comply with all applicable noise and vibration laws, ordinances, regulations and standards, and would produce no significant adverse noise impacts on people within the affected area, directly, indirectly, or cumulatively. The applicant has proposed appropriate mitigation, in the form of good design practice and selection of appropriate project equipment that would avoid any significant adverse impacts.

INTRODUCTION

The construction and operation of any power plant creates noise or unwanted sound. The character and loudness of this noise, the times of day or night that it is produced, and the proximity of the facility to sensitive receptors all combine to determine whether the facility would meet applicable noise control laws and ordinances and whether it would cause significant adverse environmental impacts. In some cases, vibration may be produced as a result of power plant construction practices such as blasting or pile driving. The ground-borne energy of vibration has the potential to cause structural damage and annoyance.

The purpose of this analysis is to identify and examine the likely noise and vibration impacts from the construction and operation of the HHSEGS project, and to recommend procedures to ensure that the resulting noise and vibration impacts would be adequately mitigated to comply with applicable laws, ordinances, regulations and standards (LORS). For an explanation of technical terms used in this section, please refer to **Noise Appendix A**, immediately following.

For noise and vibration impacts on biological resources, please see the **BIOLOGICAL RESOURCES** section of this Final Staff Assessment (**FSA**).

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

METHODS AND THRESHOLDS FOR DETERMINING SIGNIFICANCE

California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires that significant environmental impacts be identified and either eliminated or mitigated to the extent feasible. Section XI of Appendix G of CEQA's guidelines (Cal. Code Regs., tit. 14, App. G) describes some characteristics that could signify a potentially significant impact. Specifically, a significant effect from noise may exist if a project would result in:

1. exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

2. exposure of persons to or generation of excessive ground borne vibration or ground borne noise levels;

3. substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project; or

4. substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

The Energy Commission staff, in applying Item 3, above, to the analysis of this and other projects, has concluded that a potential for a significant noise impact exists where the noise of the project plus the background exceeds the background by more than 5 dBA at the nearest sensitive receptor.

Staff has concluded that a permanent increase in background noise levels up to and including 5 dBA in a residential setting is insignificant; an increase of more than 10 dBA, however, is significant. An increase of above 5 and up to10 dBA should be considered adverse, but could be either significant or insignificant, depending upon the particular circumstances of a case.

Factors to be considered in determining the significance of an adverse impact as defined above include:

1. the resulting noise level[1];

2. the duration and frequency of the noise;

3. the number of people affected; and

4. the land use designation of the affected receptor sites.

Noise due to construction activities is usually considered to be insignificant in terms of CEQA compliance if:

- the construction activity is temporary; and
- the use of heavy equipment and noisy[2] activities is limited to daytime hours.

Staff uses the above method and threshold to protect the most sensitive populations.

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[1] For example, a noise level of 40 dBA would be considered quiet in many locations. A noise limit of 40 dBA would be consistent with the recommendations of the California Model Community Noise Control Ordinance for rural environments and with industrial noise regulations adopted by European jurisdictions. If the project would create an increase in ambient noise no greater than 10 dBA at nearby sensitive receptors, and the resulting noise level would be 40 dBA or less, the project noise level would be insignificant.

[2] Noise that draws legitimate complaint (for the definition of “legitimate complaint”, see the footnote in Condition of Certification **NOISE-4**)

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

Noise Table 1

Laws, Ordinances, Regulations and Standards

Applicable Law	Description
Federal: Occupational Safety & Health Act (OSHA): 29 U.S.C. § 651 et seq.	Protects workers from the effects of occupational noise exposure
U.S. Environmental Protection Agency (USEPA)	Assists state and local government entities in development of state and local LORS for noise
State: California Occupational Safety & Health Act (Cal-OSHA): 29 U.S.C. § 651 et seq., Cal. Code Regs., tit. 8, §§ 5095-5099	Protects workers from the effects of occupational noise exposure
Local: Inyo County General Plan	Establishes acceptable levels for noise, based on land use. Establishes hourly limits for construction activities within 500 feet of existing noise-sensitive land uses.

FEDERAL

Under the Occupational Safety and Health Act of 1970 (OSHA) (29 U.S.C. § 651 et seq.), the Department of Labor, Occupational Safety and Health Administration, (OSHA) adopted regulations (29 C.F.R. § 1910.95) designed to protect workers against the effects of occupational noise exposure. These regulations list permissible noise exposure levels as a function of the amount of time during which the worker is exposed (see **Noise Appendix A, Table A4**, immediately following this section). The regulations further specify a hearing conservation program that involves monitoring the noise to which workers are exposed, assuring that workers are made aware of overexposure to noise, and periodically testing the workers' hearing to detect any degradation.

Guidelines are available from the U.S. Environmental Protection Agency (USEPA) to assist state and local government entities in developing state and local LORS for noise. Because there are existing local LORS that apply to this project, the USEPA guidelines are not applicable.

There are no federal laws governing off-site (community) noise.

The Federal Transit Administration (FTA) has published guidelines for assessing the impacts of ground-borne vibration associated with construction of rail projects, which have been applied by other jurisdictions to other types of projects. The FTA-recommended vibration standards are expressed in terms of the "vibration level," which is calculated from the peak particle velocity measured from ground-borne vibration. The

FTA measure of the threshold of perception is 65 vibrational decibels (VdB), which correlates to a peak particle velocity of about 0.002 inches per second (in/sec). The FTA measure of the threshold of architectural damage for conventional sensitive structures is 100 VdB, which correlates to a peak particle velocity of about 0.2 in/sec.

STATE

California Government Code Section 65302(f) encourages each local governmental entity to perform noise studies and implement a noise element as part of its general plan. In addition, the California Office of Planning and Research has published guidelines for preparing noise elements, which include recommendations for evaluating the compatibility of various land uses as a function of community noise exposure.

The State of California, Office of Noise Control, prepared the Model Community Noise Control Ordinance, which provides guidance for acceptable noise levels in the absence of local noise standards. This model also defines a simple tone, or "pure tone," as one-third octave band sound pressure levels that can be used to determine whether a noise source contains annoying tonal components. The Model Community Noise Control Ordinance further recommends that, when a pure tone is present, the applicable noise standard should be lowered (made more stringent) by five A-weighted decibels (dBA).

The California Occupational Safety and Health Administration (Cal-OSHA) has promulgated occupational noise exposure regulations (Cal. Code Regs., tit. 8, §§ 5095-5099) that set employee noise exposure limits. These standards are equivalent to federal OSHA standards (see **Noise Appendix A, Table A4**).

LOCAL

The project is located within Inyo County. The Public Safety Element of the Inyo County General Plan[3] applies to this project.

Inyo County General Plan Public Safety Element

The Public Safety Element addresses noise and establishes goals, policies and implementation measures that regulate noise occurring within the county's jurisdiction. For residences, schools and churches, the Noise Element establishes a Normally Acceptable Day-Night Noise Level (L_{dn}) of 60 dBA. The Normally Acceptable L_{dn} of 60 dBA equates to an Equivalent Noise Level (L_{eq}) of 54 dBA continuously throughout the day and night.

The General Plan also requires that construction activities occurring within 500 feet of existing noise sensitive uses be limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Saturday (INYO2001a).

[3] The Inyo County General Plan may be accessed online at the following link - http://inyoplanning.org/general_plan/index.htm.

SETTING AND EXISTING CONDITIONS

HHSEGS would be located on approximately 3,097 acres of privately owned land leased in Inyo County, California, adjacent to the Nevada border. The project site is approximately eight miles south of Pahrump, Nevada, and approximately 45 miles west of Las Vegas, Nevada.

The area is sparsely populated, with a few scattered residences south and southeast of the HHSEGS site. The nearest residence to the proposed HHSEGS's nearest power block (Solar Plant 2, as shown in **Noise Figure 1**) would be approximately 3,500 feet south of this power block. This residence is referred to as CR1 in this analysis.

The St. Therese Mission, a commercial facility, referred to as location M1 in this analysis, has broken ground on 17.5 acres, approximately 1.7 miles from the nearest power block (see **Noise Figure 1**). It will consist of a chapel, columbarium, garden, restaurant, visitor's center, playground, restrooms, and an onsite caretaker home.

AMBIENT NOISE MONITORING

In order to establish a baseline for the comparison of predicted project noise with existing ambient noise, the applicant has presented the results of an ambient noise survey (HHSG 2011a, AFC § 5.7.4.1; Table 5.7-5). Ambient noise levels were measured at M1 (St. Therese Mission) and a nearby residence shown as location M2 in **Noise Figure 1**. M2 is not the closest residence; however, this location was used for the noise monitoring because, according to the applicant, the owners of M2 were the first to agree to provide access to their property for the monitoring equipment. The monitoring information gathered at M2 was used to establish existing noise levels at the closest residence, CR1. Because the existing ambient environment surrounding M2 and CR1 are similar, staff concludes this method used to establish existing noise levels at CR1 is reasonable.

The noise survey was conducted continuously from May 18 to May 27, 2011. The survey was performed using acceptable equipment and techniques. The noise survey monitored existing noise levels at or near the following noise-sensitive receptors, shown in **Noise Figure 1**.

Noise Table 2 summarizes the ambient noise measurements (HHSG 2011a, AFC § 5.7.4.1; Table 5.7-5).

Noise Table 2
Summary of Measured Noise Levels

Measurement Sites	Measured Noise Levels, dBA		
	Average During Daytime Hours (7 a.m. to 10 p.m.) L_{eq}	Average During Nighttime Hours (10 p.m. to 7 a.m.) L_{eq}	Average L_{dn}
M2, Used for Nearest Residence, **CR1**, 3,500 Feet South of Nearest Power Block	45[1]	40[1]	51
M1, St. Therese Mission, 1.7 Miles East of Nearest Power Block	42[1]	34[2]	47

Source: HHSG 2011a, AFC § 5.7.4.1; Table 5.7-5
1. Staff calculations of average of the daytime hours
2. Staff calculations of average of the nighttime hours.

DIRECT AND INDIRECT IMPACTS AND MITIGATION

Noise impacts associated with the project can be created by short-term construction activities and normal long-term operation of the project.

CONSTRUCTION IMPACTS AND MITIGATION

Construction noise is usually a temporary phenomenon. Construction of the HHSEGS project is expected to be typical of similar projects in terms of equipment used and other types of activities (HHSG 2011a, AFC § 5.7.5.2).

COMPLIANCE WITH LORS

Construction of an industrial facility such as a power plant is typically noisier than permissible under usual noise ordinances. In order to allow the construction of new facilities, construction noise during certain hours of the day is commonly exempt from enforcement by local ordinances.

The applicant has predicted construction noise levels at 50 feet and one mile away for various construction activities. Staff has used these levels to calculate the noise levels at CR1 and M1. They are shown here in **Noise Table 3**.

Noise Table 3: Predicted Construction Noise Levels

Receptor	Type of Construction Activity	Highest Construction Noise Level L_{eq} (dBA) [1]	Measured Existing Ambient, Average Daytime L_{eq} (dBA) [2]	Cumulative, Construction Plus Ambient	Change
CR1	Concrete Pouring	41	45	46	+1
	Steel Erection & Mechanical	50		51	+6
	Site Cleaning, Excavation, & Cleanup	53		54	+9
M1	Concrete Pouring	33	42	43	+1
	Steel Erection & Mechanical	43		46	+4
	Site Cleaning, Excavation, & Cleanup	44		46	+4

Sources: [1] EPA, 1971, Barnes et al., 1976, HHSG 2011a, AFC Table 5.7-6, and staff calculations
[2] Noise Table 2, above

The applicable local noise LORS do not limit the loudness of construction noise, but staff compares the projected noise levels with ambient levels (please see the following discussion under **CEQA Impacts**).

The applicant commits to performing noisy construction work during the times specified in the Inyo County General Plan, during the hours of 7:00 a.m. to 7:00 p.m. Monday through Saturday (HHSG 2011a, AFC § 5.7.7.3). To ensure that these hours are, in fact, enforced, staff proposes Condition of Certification **NOISE-6**.

Therefore, the noise impacts of the HHSEGS project construction activities would comply with the noise LORS.

CEQA IMPACTS

Since construction noise typically varies with time, it is most appropriately measured by, and compared with, the L_{eq} (energy average) metric. As seen in **Noise Table 3** above, last column construction noise would elevate the existing ambient noise levels at the noise-sensitive receptors by no more than 9 dBA. An increase of above 5 and up to10 dBA could be either significant or insignificant, depending upon the particular circumstances of a case. Because construction would be temporary, most construction activities would occur during the daytime hours, and typical industry noise abatement

measures would be implemented for noise-producing equipment, staff believes construction noise during the daytime hours would not have a significant adverse impact on the project's noise-sensitive receptors.

To ensure project construction would create less than significant adverse impacts at the most noise-sensitive receptors, in addition to Condition of Certification **NOISE-6**, staff proposes Conditions of Certification **NOISE-1** and **NOISE-2**, which would establish a public notification and noise complaint process to resolve any complaints regarding construction noise.

In light of the following proposed conditions of certification below, the noise impacts of the HHSEGS project construction activities would be less than significant.

Steam Blows

Typically, the loudest noise encountered during construction, inherent in building any project incorporating a steam turbine, is created by the steam blows. After erection and assembly of the feed water and steam systems, the piping and tubing that comprise the steam path have accumulated dirt, rust, scale, and construction debris such as weld spatter, dropped welding rods, and the like. If the plant were started up without thoroughly cleaning out these systems, all this debris would find its way into the steam turbine, quickly destroying the machine.

In order to prevent this, before the steam system is connected to the turbine, the steam line is temporarily routed to the atmosphere. Traditionally, high pressure steam is then raised in the boiler or a temporary boiler and allowed to escape to the atmosphere through the steam piping. This flushing action, referred to as a "high pressure steam blow", is quite effective at cleaning out the steam system. A series of short steam blows, lasting two or three minutes each, are performed several times daily over a period of two or three weeks. At the end of this procedure, the steam lines are connected to the steam turbine, which is then ready for operation. Alternatively, high pressure compressed air can be substituted for steam.

High pressure steam blows, if unsilenced, can typically produce noise levels as high as 129 dBA at a distance of 50 feet; this would amount to roughly 90 dBA at CR1 and roughly 81 dBA at M1. Unsilenced steam blows could be disturbing at the nearest noise-sensitive receptors, depending on the frequency, duration, and noise intensity of venting. With a silencer installed on the steam blow piping, noise levels are commonly attenuated to 89 dBA at 50 feet; steam blow at the southern power block (Solar Plant 2), nearer to the noise-sensitive receptors, would amount to roughly 50 dBA at CR1 and roughly 41 at M1 (staff calculation). These levels are acceptable. Thus, staff proposes Condition of Certification **NOISE-7** (below) in order to limit steam blow noise to 89 dBA at 50 feet, and to limit this activity to daytime hours.

A quieter steam blow process, referred to as "low pressure steam blow" and marketed under names such as QuietBlow™ or Silentsteam™, has become popular. This method utilizes lower pressure steam over a continuous period of about 36 hours. Resulting noise levels reach about 86 dBA at 50 feet.

Linear Facilities

Construction of linear facilities typically moves along at a rapid pace, thus not subjecting any one receptor to noise impacts for more than two or three days. Further, construction activities would be limited to daytime hours (please see Condition of Certification **NOISE-6**).

Vibration

The only construction operation likely to produce vibration that could be perceived off site would be pile driving. The applicant anticipates that pile driving might be required for construction of the HHSEGS project (HHSG 2011a, AFC § 5.7.5.2.3).

Pile driving will not cause perceptible vibration at any of the project's receptors due to their relatively long distances to construction activities.

Information from other projects examined by staff shows the noise from pile driving could be expected to reach 104 dBA at a distance of 50 feet. The noise level from pile driving at Solar Plant 2 would thus be projected to reach a level of roughly 65 dBA at CR1 and 57 dBA at M1 (staff calculations). Assuming daytime noise levels at CR1 of 45 dBA and at M1 of 42 dBA, adding pile driving noise to the daytime ambient levels would produce increases of 20 dBA at CR1 and 15 dBA at M1. An increase of 15-20 dBA would likely constitute an annoyance. Thus, pile driving using traditional techniques can potentially cause a significant noise impact at the nearest noise-sensitive receptors. Staff recommends that pile driving be performed using a quieter process. Staff has identified several commercially available technologies that reduce pile driving noise by 20 to 40 dBA compared to traditional pile driving techniques. These include padded hammers, "Hush" noise-attenuating enclosures, vibratory drivers, and hydraulic techniques that press the piles into the ground instead of hammering them (Eaton 2000, Gill 1983, Ken-Jet, Kessler & Schomer 1980, NCT, WOMA 1999, Yap 1987). To ensure that pile driving noise will be performed with quieter equipment, staff proposes Condition of Certification **NOISE-8**. Also to ensure that pile driving noise will not cause annoyance, pile driving will be limited to daytime hours. To ensure this, staff proposes Condition of Certification **NOISE-6**, below.

Worker Effects

The applicant has acknowledged the need to protect construction workers from noise hazards and has recognized applicable LORS that would protect construction workers (HHSG 2011a, AFC § 5.7.5.2.1). To ensure that construction workers are, in fact, adequately protected, staff has proposed Condition of Certification **NOISE-3**.

OPERATION IMPACTS AND MITIGATION

The primary noise sources of the HHSEGS project would be the power blocks, where the steam turbine generators, air-cooled condensers, electric transformers, and various pumps and fans would be located. The northern power block would be located in, or, near the center of Solar Plant 1 (see **Noise Figure 1**), surrounded by a series of heliostats. This power block would be approximately 2 miles from CR1. The southern power block would be located in, or, near the center of Solar Plant 2 (see

Noise Figure 1), surrounded by a series of heliostats. This power block would be approximately 3,500 feet from CR1. The overall noise generated by the project's various noise sources would be based on the configuration of the sources, the number and power rating of the equipment, and any noise-reducing measures incorporated. Staff compares the projected project noise with applicable LORS, in this case the Inyo County noise LORS[4]. In addition, staff evaluates any increase in noise levels at sensitive receptors due to the project in order to identify any significant adverse impacts (see **CEQA Impacts**, below). The project would avoid the creation of annoying tonal (pure-tone) noises by balancing the noise emissions of various power plant features during plant design (Condition of Certification **NOISE-4**).

Compliance with LORS

The applicant performed noise modeling to determine the project's noise impacts on sensitive receptors (HHSG 2011a, AFC § 5.7.5.3.2). The applicant has predicted the operational noise levels at the nearest sensitive receptors; they are shown in **Noise Table-4** below. The County's Noise Element establishes a Normally Acceptable Day-Night Noise Level (L_{dn}) of 60 dBA. The Normally Acceptable L_{dn} of 60 dBA equates to an Equivalent Noise Level (L_{eq}) of 54 dBA continuously throughout the day and night. The applicant predicts the project's operational noise levels at receptor CR1 to be 54 dBA L_{eq} and at receptor M1 to be 52 dBA L_{eq} (**Noise Table 4** below). These levels are consistent with the LORS requirements. To ensure compliance with this LORS, staff proposes Condition of Certification **NOISE-4**. (For the reasons explained below, under **CEQA IMPACTS**, Condition of Certification **NOISE-4** limits the project's noise levels to lower than those predicted, at CR1 and M1.)

Also to ensure compliance, staff proposes Conditions of Certification **NOISE-1** and **NOISE-2** which would establish a public notification and noise complaint process requiring the applicant to resolve any problems caused by operational noise.

With implementation of the conditions of certification below, noise due to the operation of the HHSEGS project would be in compliance with the applicable LORS.

CEQA IMPACTS

The HHSEGS project would operate during the daylight hours (when the sun is shining). Thus, staff compares the project's noise levels to the existing daytime ambient noise levels at the project's noise-sensitive receptors. (Please see below for limited nighttime activities.) Typically, daytime ambient noise consists of both intermittent and constant noises. The noise that stands out during this time is therefore best represented by the average noise level, referred to as L_{eq}. Staff's evaluation of the above noise surveys shows that the daytime noise environment in the project area consists of both intermittent and constant noises. Thus, staff compares the project's noise levels to the daytime ambient L_{eq} levels at the project's noise-sensitive receptors. The applicant has predicted the operational noise level at CR1 and M1; they are shown here in **Noise Table 4**.

[4] Title 21, Chapter 21.20.20, (Development Standards for Renewable Energy Development) of the Inyo County Code - http://qcode.us/codes/inyocounty/

Noise Table 4: Predicted Operational Noise Levels at the Identified Sensitive Residential Receptors

Receptor	Project Alone Operational Noise Level (dBA) [1]	Measured Existing Ambient, Daytime L_{eq} (dBA) [2]	Cumulative L_{eq} (dBA)	Increase in Existing Ambient (dBA)
CR1	54	45	55	+10
M1	52	42	52	+10

Sources: [1] HHSG2011a, AFC § 5.7.5.3.2
[2] Noise Table 2, above

Combining the ambient noise level of 45 dBA L_{eq} (**Noise Table 4**, above) with the project noise level of 54 dBA at CR1 would result in 55 dBA L_{eq}, 10 dBA above the ambient. Combining the ambient noise level of 42 dBA L_{eq} (**Noise Table 4**, above) with the project noise level of 52 dBA at M1 would result in 52 dBA L_{eq}, 10 dBA above the ambient.

As described above (in **METHODS AND THRESHOLDS FOR DETERMINING SIGNIFICANCE**), staff regards an increase of above 5 and up to10 dBA to be adverse, but considers it to be either significant or insignificant, depending upon the particular circumstances of a case. The project would operate during the daytime hours and would not operate at night, when people are trying to sleep. Typically, staff considers an increase of up to 10 dBA to be less than significant if the noise occurs during the day. In the PSA staff concluded that a 10 dBA increase in the exisiting ambient levels at CR1 and M1 would cause a less-than-significant impact because the project would operate during the day and because staff's impression was that most of the people residing in the project vicinity commute to work; leaving their homes every weekday morning and returning home in late afternoons/evenings. After the writing of the PSA, staff learned that this situation may not exist in Charleston View, represented by CR1, and the residents may typically go about their normal daily activities mostly within the boundaries of this community.

Thus, in this **FSA** staff has further evaluated, in more details, the effect of a 10 dBA increase in the ambient noise levels at the project's sensitive noise receptors. In determining whether or not a project would create a significant adverse noise impact, one of the other factors that staff considers is the character of the existing noise regime that people are accustomed to, versus the character of the noise created by the noise source (i.e.; power plant). This is especially important in a rural environment with a generally quiet noise regime. The existing daytime noise environment in the project area is considered quiet and Charleston View is located in a rural setting. People residing near the proposed project site (i.e.; the residence of Charleston View) are more accustomed to natural sounds and noises from light human activities than to industrial noises; currently, the environment is dominated by non-industrial noise sources.

Therefore, the project's industrial noise character combined with an increase of 10 dBA at the project's noise-sensitive receptors would likely prove to cause annoyance, considering the presence of people in Charleston View during the day. Thus, staff considers the above noise impacts at CR1 and M1 to be significant.

In order to reduce the projected noise levels shown in **Noise Table 4** to a level that would result in a less than 10 dBA increase at CR1 and M1, additional mitigation measures (beyond those embedded in the design of the project) may be required. Staff believes that adequate feasible mitigation measures are available to reduce the project noise alone by up to 3 dBA at CR1, but any reduction beyond that would likely be extremely difficult to achieve, considering the quiet character of the noise environment and the lack of intervening structures or topographical/natural barriers between the project site and the noise-sensitive receptors. Thus, staff concludes that the projected project noise levels must be reduced.

A reduction of 3 dBA at CR1 would result in a project noise level of 51 dBA. Combining the ambient noise level of 45 dBA L_{eq} (**Noise Table 5**, below) with the project noise level of 51 dBA at CR1 would result in 52 dBA L_{eq}, 7 dBA above the ambient. A reduction of 3 dBA at M1 would result in a project noise level of 49 dBA. Combining the ambient noise level of 42 dBA L_{eq} (**Noise Table 5**, below) with the project noise level of 49 dBA at M1 would result in 50 dBA L_{eq}, 8 dBA above the ambient.

Noise Table 5: Staff-Proposed Operational Noise Levels at the Identified Sensitive Residential Receptors

Receptor	Project Alone Operational Noise Level (dBA) [1]	Measured Existing Ambient, Daytime L_{eq} (dBA) [2]	Cumulative L_{eq} (dBA)	Increase in Existing Ambient (dBA)
CR1	51	45	52	+7
M1	49	42	50	+8

Sources: [1] Noise Table 2, above

In order to ensure the applicant adheres to these levels, staff has revised Condition of Certification **NOISE-4** to require the project's noise to comply with the levels shown in **Noise Table 5**, rather than those in **Noise Table 4** (as appeared in the PSA).

Adverse impacts on residential receptors can also be identified by comparing predicted power plant noise levels with the nighttime ambient background noise levels at the nearest sensitive residential receptors. The project would have limited nighttime activities related to maintenance. Given the solar nature of this project, activity at night will be limited to primarily maintenance related activities such as mirror washing, with lower noise levels than those from operational activities (during the day). Mirror washing activities are expected to be similar in sound level to a heavy truck. Mirror washing will move around the project area returning to a particular group of mirrors approximately every two weeks, not having the potential to cause annoyance at the noise-sensitive residential receptors, due to its short-term nature. Therefore, staff considers this impact to be less than significant.

However, in the event that mirror washing noise becomes disturbing, the impact can be reduced by such measures as limiting the mirror washing hours near the residential receptors to the early evening hours rather than the late night hours. Also, the plant may not always operate at 100 percent of full power output, especially in the morning hours immediately following the sunrise due to the unavailability of adequate solar insolation.

This can provide an additional opportunity for mirror washing. The mirrors located near the residents can be washed during those hours instead of at night.

If further mitigation is needed, noise can be reduced by such measures as replacing the diesel-powered reflector cleaning vehicle and conventional combustion engine-powered portable lighting plant with an electric-powered vehicle and battery-powered portable lighting plant.

Tonal Noises

One possible source of annoyance could be strong tonal noises. Tonal noises are individual sounds (such as pure tones) which, while not louder than permissible levels, stand out in sound quality. To ensure that tonal noises do not cause public annoyance, staff proposes Condition of Certification **NOISE-4**, which would require mitigation measures, if necessary, to ensure the project would not create tonal noises.

Linear Facilities

All water pipes and gas pipes would be underground and therefore silent during plant operation. Noise effects from electrical interconnection lines typically do not extend beyond the lines' right-of-way easements and would be inaudible to receptors.

Vibration

Vibration from an operating power plant could be transmitted through two primary means: ground (ground-borne vibration), and air (airborne vibration).

The operating components of the HHSEGS plant would consist of high-speed steam turbine generators and various pumps and fans. All of these pieces of equipment must be carefully balanced in order to operate; permanent vibration sensors would be attached to the turbines and generators. Based on experience with numerous previous projects employing similar equipment, staff agrees with the applicant that ground-borne vibration from the HHSEGS project would be undetectable by any likely receptor.

Airborne vibration (low frequency noise) can rattle windows and objects on shelves and can rattle the walls of lightweight structures. However, none of the project equipment is known to produce noticeable low frequency noise beyond the project site boundaries. Staff concludes that the HHSEGS would not cause perceptible airborne vibration effects at any offsite noise-sensitive receptor.

Worker Effects

The applicant acknowledges the need to protect plant operating and maintenance workers from noise hazards and commits to compliance with all applicable LORS (HHSG 2011a, AFC § 5.7.5.3.1). Signs would be posted in areas of the plant with noise levels exceeding 85 dBA (the level that OSHA recognizes as a threat to workers' hearing), and hearing protection would be required and provided. To ensure that plant operation and maintenance workers are adequately protected, staff proposes Condition of Certification **NOISE-5**. For further discussion of proposed worker safety conditions of certification, please see **WORKER SAFETY AND FIRE PROTECTION** section of this document.

CUMULATIVE IMPACTS AND MITIGATION

Section 15130 of the CEQA Guidelines (Cal. Code Regs., tit. 14) requires a discussion of cumulative environmental impacts. Cumulative impacts are two or more individual impacts that, when considered together, are considerable or that compound or increase other environmental impacts. The CEQA Guidelines require that the discussion reflect the severity of the impacts and the likelihood of their occurrence, but need not provide as much detail as the discussion of the impacts attributable to the project alone.

The St. Therese Mission is the only proposed project near the HHSEGS site to potentially result in a cumulative noise effect. The facility developer estimates that as many as 1,200 visitors per month could visit the facility. The noise generated from such visitors would be predominately associated with vehicular traffic. Other features associated with the St. Therese Mission project are not anticipated to be significant sources of noise. Therefore, it is unlikely that HHSEGS, when combined with other projects, would create direct cumulative noise impact in the project area. Therefore, the project's cumulative noise impact is considered to be less than significant.

FACILITY CLOSURE

In the future, upon closure of the HHSEGS, all operational noise from the project would cease, and no further adverse noise impacts from operation of the HHSEGS would be possible. The remaining potential temporary noise source is the dismantling of the structures and equipment and any site restoration work that may be performed. Since this noise would be similar to that caused by the original construction, it can be treated similarly. That is, noisy work could be performed during daytime hours, with machinery and equipment properly equipped with mufflers. Any noise LORS that were in existence at that time would apply. Applicable conditions of certification included in the Energy Commission decision would also apply unless modified.

STAFF PROPOSED FINDINGS OF FACT

1. Construction and operation of the HHSEGS would not significantly increase noise levels above existing ambient levels in the surrounding project area.

2. Construction noise levels are temporary and transitory in nature and would be mitigated to the extent feasible by employing measures such as sound reduction devices and limiting construction to daytime hours in accordance with the Public Safety Element of the Inyo County General Plan.

3. Measures contained in the Conditions of Certification and compliance with local LORS would assure that noise from construction and operation is mitigated to below the level of significance.

4. Operational noise would not cause significant impacts to nearby residences.

5. The project owner would implement measures to protect workers from injury due to excessive noise levels.

6. The HHSEGS would not create ground or airborne vibrations which could cause significant off-site impacts.

7. Implementation of the Conditions of Certification identified below, ensure that project-related noise emissions would not cause significant impacts to sensitive noise receptors.

CONCLUSIONS

Staff concludes that the HHSEGS project, if built and operated in conformance with the proposed conditions of certification below, would comply with all applicable noise and vibration LORS and would produce no significant direct or cumulative adverse noise impacts on people within the project area, directly, indirectly, or cumulatively.

PROPOSED CONDITIONS OF CERTIFICATION

PUBLIC NOTIFICATION PROCESS

NOISE-1 Prior to the start of ground disturbance, the project owner shall notify all residents within one mile of the project site boundaries, by mail or by other effective means, of the commencement of project construction. At the same time, the project owner shall establish a telephone number for use by the public to report any undesirable noise conditions associated with the construction and operation of the project. If the telephone is not staffed 24 hours a day, the project owner shall include an automatic answering feature, with date and time stamp recording, to answer calls when the phone is unattended. This telephone number shall be posted at the project site during construction where it is visible to passersby. This telephone number shall be maintained throughout the operational life of the project.

Verification: At least 15 days prior to ground disturbance, the project owner shall transmit to the compliance project manager (CPM) a statement, signed by the project owner's project manager, stating that the above notification has been performed, and describing the method of that notification. This communication shall also verify that the telephone number has been established and posted at the site, and shall provide that telephone number.

NOISE COMPLAINT PROCESS

NOISE-2 Throughout the construction and operation of the project, the project owner shall document, investigate, evaluate, and attempt to resolve all project-related noise complaints. The project owner or authorized agent shall:

- use the Noise Complaint Resolution Form (below), or a functionally equivalent procedure acceptable to the CPM, to document and respond to each noise complaint;
- attempt to contact the person(s) making the noise complaint within 24 hours;

- conduct an investigation to determine the source of noise in the complaint;
- if the noise is project related, take all feasible measures to reduce the source of the noise; and
- submit a report documenting the complaint and actions taken. The report shall include: a complaint summary, including the final results of noise reduction efforts and, if obtainable, a signed statement by the complainant, stating that the noise problem has been resolved to the complainant's satisfaction.

Verification: Within five days of receiving a noise complaint, the project owner shall file a Noise Complaint Resolution Form, shown below, with the CPM, which documents the resolution of the complaint. If mitigation is required to resolve the complaint, and the complaint is not resolved within a three-day period, the project owner shall submit an updated Noise Complaint Resolution Form when the mitigation is performed and complete.

EMPLOYEE NOISE CONTROL PROGRAM

NOISE-3 The project owner shall submit to the CPM for review and approval a noise control program. The noise control program shall be used to reduce employee exposure to high (above permissible) noise levels during construction in accordance to the applicable OSHA and Cal-OSHA standards.

Verification: At least 30 days prior to the start of ground disturbance, the project owner shall submit the noise control program to the CPM. The project owner shall make the program available to Cal-OSHA upon request.

NOISE RESTRICTIONS

NOISE-4 The project design and implementation shall include appropriate noise mitigation measures adequate to ensure that the operation of the project will not cause the noise levels due to plant operation alone to exceed an average of 51 dBA L_{eq} measured at or near monitoring location CR1 and an average of 49 dBA L_{eq} measured at or near monitoring location M1.

No new pure-tone components shall be caused by the project. No single piece of equipment shall be allowed to stand out as a source of noise that draws legitimate complaints[5].

When the project first achieves a sustained output of 90 % or greater of rated capacity, the project owner shall conduct a 25-hour community noise survey at monitoring locations CR1 and M1, or at a closer location acceptable to the CPM. This survey shall also include measurement of one-third octave band

[5] A legitimate complaint refers to a complaint about noise that is caused by the HHSEGS project as opposed to another source (as verified by the CPM). A legitimate complaint constitutes a violation by the project of any noise condition of certification (as confirmed by the CPM), which is documented by an individual or entity affected by such noise.

sound pressure levels to ensure that no new pure-tone noise components have been caused by the project.

The measurement of power plant noise for the purposes of demonstrating compliance with this condition of certification may alternatively be made at a location, acceptable to the CPM, closer to the plant (e.g., 400 feet from the plant boundary) and this measured level then mathematically extrapolated to determine the plant noise contribution at the affected residence. The character of the plant noise shall be evaluated at the affected receptor locations to determine the presence of pure tones or other dominant sources of plant noise.

If the results from the noise survey indicate that the power plant noise at the affected receptor sites exceed the above values, mitigation measures shall be implemented to reduce noise to a level of compliance with these limits.

If the results from the noise survey indicate that pure tones are present, mitigation measures shall be implemented to eliminate the pure tones.

Verification: The survey shall take place within 30 days of the project first achieving a sustained output of 90 % or greater of rated capacity. Within 15 days after completing the survey, the project owner shall submit a summary report of the survey to the CPM. Included in the survey report will be a description of any additional mitigation measures necessary to achieve compliance with the above listed noise limits, and a schedule, subject to CPM approval, for implementing these measures. When these measures are in place, the project owner shall repeat the noise survey.

Within 15 days of completion of the new survey, the project owner shall submit to the CPM a summary report of the new noise survey, performed as described above and showing compliance with this condition.

OCCUPATIONAL NOISE SURVEY

NOISE-5 Following the project's attainment of a sustained output of 90 % or greater of its rated capacity, the project owner shall conduct an occupational noise survey to identify any noise hazardous areas in the facility.

The survey shall be conducted by a qualified person in accordance with the provisions of Title 8, California Code of Regulations, sections 5095-5099 (Article 105) and Title 29, Code of Federal Regulations, section 1910.95. The survey results shall be used to determine the magnitude of employee noise exposure.

The project owner shall prepare a report of the survey results and, if necessary, identify proposed mitigation measures to be employed in order to comply with the applicable California and federal regulations.

Verification: Within 30 days after completing the survey, the project owner shall submit the noise survey report to the CPM. The project owner shall make the report available to OSHA and Cal-OSHA upon request.

CONSTRUCTION RESTRICTIONS

NOISE-6 Heavy equipment operation and noisy construction work relating to any

project features, including pile driving, shall be restricted to the times delineated below:

Mondays through Saturdays: 7 a.m. to 7 p.m.

Construction activities may be performed outside the above hours, with CPM approval.

Haul trucks and other engine-powered equipment shall be equipped with adequate mufflers. Haul trucks shall be operated in accordance with posted speed limits. Truck engine exhaust brake use shall be limited to emergencies.

Verification: Prior to ground disturbance, the project owner shall transmit to the CPM a statement acknowledging that the above restrictions will be observed throughout the construction of the project.

At least 5 days prior to pouring of concrete outside of the above hours, the project owner shall submit a statement to the CPM, specifying the time of night and the number of nights for which concrete pouring will occur, the approximate distance of this activity to CR1 an M1, and the expected sound levels at these receptors. Also prior to pouring of concrete beyond the above hours, the project owner shall notify all residents within one mile of the project site boundaries, by mail or by other effective means, of the commencement of this activity.

STEAM BLOW RESTRICTIONS

NOISE-7 If a traditional, high-pressure steam blow process is used the project owner shall equip steam blow piping with a temporary silencer that quiets the noise of steam blows to no greater than 89 dBA measured at a distance of 50 feet. The steam blows shall be conducted between 8:00 a.m. and 5:00 p.m. unless arranged with the CPM such that offsite impacts would not cause annoyance to receptors. If a low-pressure, continuous steam blow process is used, the project owner shall submit to the CPM a description of the process, with expected noise levels and planned hours of steam blow operation.

Verification: At least 15 days prior to the first steam blow, the project owner shall notify all residents or business owners within one mile of the project site boundary. The notification may be in the form of letters, phone calls, fliers, or other effective means as approved by the CPM. The notification shall include a description of the purpose and nature of the steam blow(s), the planned schedule, expected sound levels, and explanation that it is a one-time activity and not part of normal plant operation.

PILE DRIVING MANAGEMENT

NOISE-8 The project owner shall perform pile driving using a quieter process than the traditional pile driving techniques to ensure that noise from this operation does not cause annoyance at monitoring locations CR1 and M1.

Verification: At least 15 days prior to first pile driving, the project owner shall submit to the CPM a description of the pile driving technique to be employed, including calculations showing its projected noise impacts at monitoring locations CR1 and M1.

Exhibit 1 - Noise Complaint Resolution Form

Hidden Hills Solar Electric Generating System Power Project
(11-AFC-2)

NOISE COMPLAINT LOG NUMBER _____

Complainant's name and address:

Phone number: _____

Date complaint received: _____
Time complaint received: _____

Nature of noise complaint:

Definition of problem after investigation by plant personnel:

Date complainant first contacted: _____

Initial noise levels at 3 feet from noise source _____ dBA Date: _____

Initial noise levels at complainant's property: _____ dBA Date: _____

Final noise levels at 3 feet from noise source: _____ dBA Date: _____

Final noise levels at complainant's property: _____ dBA Date: _____

Description of corrective measures taken:

Complainant's signature: _____ Date: _____

Approximate installed cost of corrective measures: $ _____
Date installation completed: _____
Date first letter sent to complainant: _____ (copy attached)
Date final letter sent to complainant: _____ (copy attached)

This information is certified to be correct:
Plant Manager's Signature: _____

(Attach additional pages and supporting documentation, as required).

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NOISE APPENDIX A

FUNDAMENTAL CONCEPTS OF COMMUNITY NOISE

To describe noise environments and to assess impacts on noise sensitive area, a frequency weighting measure, which simulates human perception, is customarily used. It has been found that A-weighting of sound intensities best reflects the human ear's reduced sensitivity to low frequencies and correlates well with human perceptions of the annoying aspects of noise. The A-weighted decibel scale (dBA) is cited in most noise criteria. Decibels are logarithmic units that conveniently compare the wide range of sound intensities to which the human ear is sensitive. **Noise Table A1** provides a description of technical terms related to noise.

Noise environments and consequences of human activities are usually well represented by an equivalent A-weighted sound level over a given time period (L_{eq}), or by average day and night A-weighted sound levels with a nighttime weighting of 10 dBA (L_{dn}). Noise levels are generally considered low when ambient levels are below 45 dBA, moderate in the 45 to 60 dBA range, and high above 60 dBA. Outdoor day-night sound levels vary over 50 dBA depending on the specific type of land use. Typical L_{dn} values might be 35 dBA for a wilderness area, 50 dBA for a small town or wooded residential area, 65 to 75 dBA for a major metropolis downtown (e.g., San Francisco), and 80 to 85 dBA near a freeway or airport. Although people often accept the higher levels associated with very noisy urban residential and residential-commercial zones, they nevertheless are considered to be levels of noise adverse to public health.

Various environments can be characterized by noise levels that are generally considered acceptable or unacceptable. Lower levels are expected in rural or suburban areas than what would be expected for commercial or industrial zones. Nighttime ambient levels in urban environments are about seven decibels lower than the corresponding average daytime levels. The day-to-night difference in rural areas away from roads and other human activity can be considerably less. Areas with full-time human occupation that are subject to nighttime noise, which does not decrease relative to daytime levels, are often considered objectionable. Noise levels above 45 dBA at night can result in the onset of sleep interference effects. At 70 dBA, sleep interference effects become considerable (Effects of Noise on People, U.S. Environmental Protection Agency, December 31, 1971).

In order to help the reader understand the concept of noise in decibels (dBA), **Noise Table A2** has been provided to illustrate common noises and their associated sound levels, in dBA.

Noise Table A1
Definition Of Some Technical Terms Related To Noise

Terms	Definitions
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a Sound Level Meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this testimony are A-weighted.
L_{10}, L_{50}, & L_{90}	The A-weighted noise levels that are exceeded 10%, 50%, and 90% of the time, respectively, during the measurement period. L_{90} is generally taken as the background noise level.
Equivalent Noise Level, L_{eq}	The energy average A-weighted noise level during the Noise Level measurement period.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 4.8 decibels to levels in the evening from 7 p.m. to 10 p.m., and after addition of 10 decibels to sound levels in the night between 10 p.m. and 7 a.m.
Day-Night Level, L_{dn} or DNL	The Average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10 p.m. and 7 a.m.
Ambient Noise Level	The composite of noise from all sources, near and far. The normal or existing level of environmental noise at a given location (often used for an existing or pre-project noise condition for comparison study).
Intrusive Noise	That noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.
Pure Tone	A pure tone is defined by the Model Community Noise Control Ordinance as existing if the one-third octave band sound pressure level in the band with the tone exceeds the arithmetic average of the two contiguous bands by 5 decibels (dB) for center frequencies of 500 Hz and above, or by 8 dB for center frequencies between 160 Hz and 400 Hz, or by 15 dB for center frequencies less than or equal to 125 Hz.

Source: Guidelines for the Preparation and Content of Noise Elements of the General Plan, Model Community Noise Control Ordinance, California Department of Health Services 1976, 1977.

Noise Table A2
Typical Environmental And Industry Sound Levels

Noise Source (at distance)	A-Weighted Sound Level in Decibels (dBA)	Noise Environment	Subjective Impression
Civil Defense Siren (100')	140-130		Pain Threshold
Jet Takeoff (200')	120		Very Loud
Very Loud Music	110	Rock Music Concert	
Pile Driver (50')	100		
Ambulance Siren (100')	90	Boiler Room	
Freight Cars (50')	85		
Pneumatic Drill (50')	80	Printing Press Kitchen with Garbage Disposal Running	Loud
Freeway (100')	70		Moderately Loud
Vacuum Cleaner (100')	60	Data Processing Center Department Store/Office	
Light Traffic (100')	50	Private Business Office	
Transformer (200')	40	Quiet Residential Area Library	Quiet
Soft Whisper (5')	30	Quiet Bedroom	
	20	Recording Studio	
	10		Threshold of Hearing
Source: Handbook of Noise Measurement, Arnold P.G. Peterson, 1980			

SUBJECTIVE RESPONSE TO NOISE

The adverse effects of noise on people can be classified into three general categories:

- Subjective effects of annoyance, nuisance, dissatisfaction.
- Interference with activities such as speech, sleep, and learning.
- Physiological effects such as anxiety or hearing loss.

The sound levels associated with environmental noise, in almost every case, produce effects only in the first two categories. Workers in industrial plants can experience noise effects in the last category. There is no completely satisfactory way to measure the subjective effects of noise, or of the corresponding reactions of annoyance and dissatisfaction, primarily because of the wide variation in individual tolerance of noise.

One way to determine a person's subjective reaction to a new noise is to compare the level of the existing (background) noise, to which one has become accustomed, with the level of the new noise. In general, the more the level or the tonal variations of a new noise exceed the previously existing ambient noise level or tonal quality, the less acceptable the new noise will be, as judged by the exposed individual.

With regard to increases in A-weighted noise levels, knowledge of the following relationships can be helpful in understanding the significance of human exposure to noise.

1. Except under special conditions, a change in sound level of one dB cannot be perceived.

2. Outside of the laboratory, a three dB change is considered a barely noticeable difference.

3. A change in level of at least five dB is required before any noticeable change in community response would be expected.

4. A ten dB change is subjectively heard as an approximate doubling in loudness and almost always causes an adverse community response. (Kryter, Karl D., The Effects of Noise on Man, 1970).

COMBINATION OF SOUND LEVELS

People perceive both the level and frequency of sound in a non-linear way. A doubling of sound energy (for instance, from two identical automobiles passing simultaneously) creates a three dB increase (i.e., the resultant sound level is the sound level from a single passing automobile plus three dB). The rules for decibel addition used in community noise prediction are:

Noise Table A3
Addition of Decibel Values

When two decibel values differ by:	Add the following amount to the larger value
0 to 1 dB	3 dB
2 to 3 dB	2 dB
4 to 9 dB	1 dB
10 dB or more	0

Source: Architectural Acoustics, M. David Egan, 1988

Sound and Distance

Doubling the distance from a noise source reduces the sound pressure level by 6 dB.

Increasing the distance from a noise source 10 times reduces the sound pressure level by 20 dB.

Worker Protection

OSHA noise regulations are designed to protect workers against the effects of noise exposure, and list permissible noise level exposure as a function of the amount of time to which the worker is exposed:

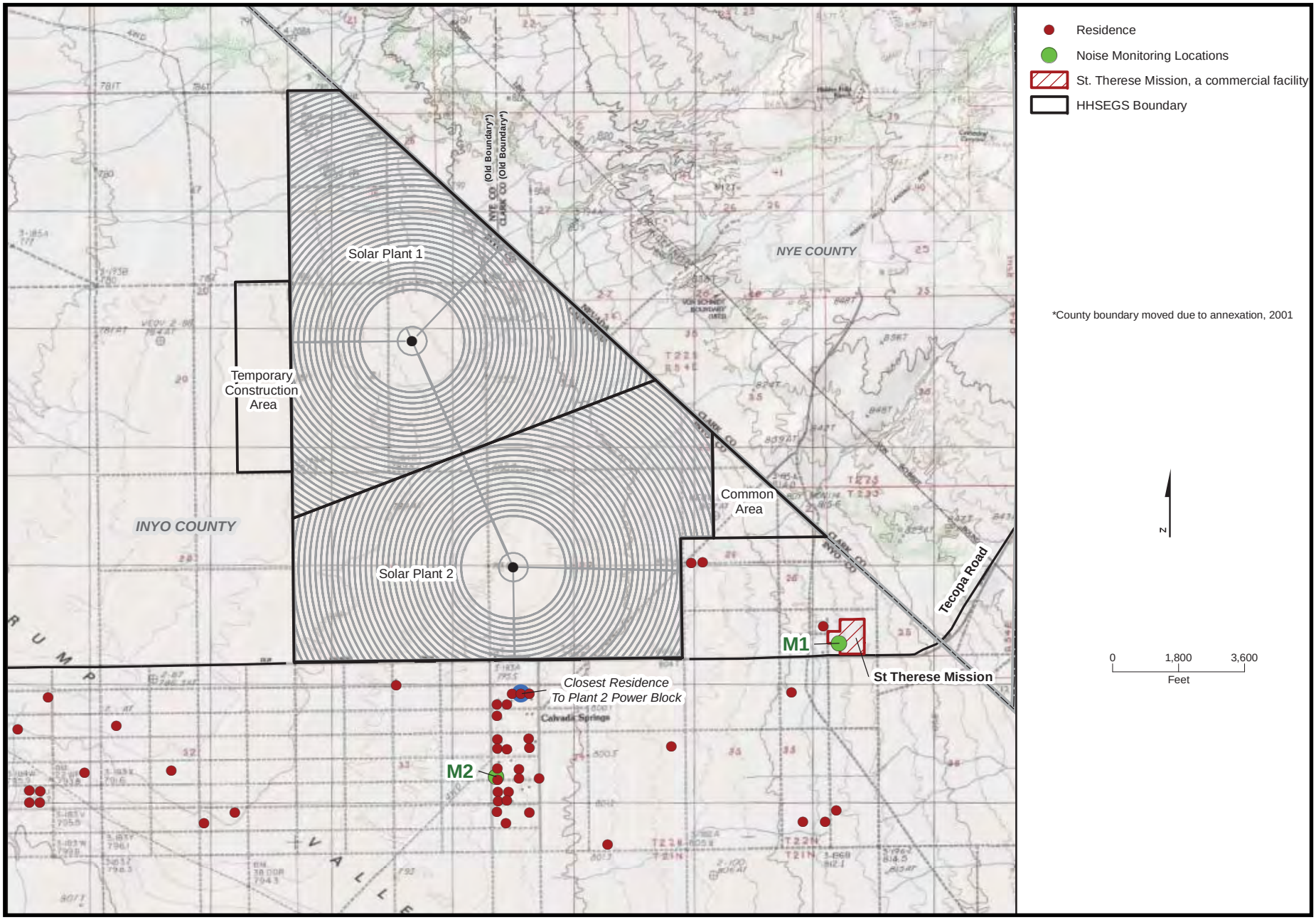
Noise Table A4
OSHA Worker Noise Exposure Standards

Duration of Noise (Hrs/day)	A-Weighted Noise Level (dBA)
8.0	90
6.0	92
4.0	95
3.0	97
2.0	100
1.5	102
1.0	105
0.5	110
0.25	115

Source: 29 C.F.R. § 1910.

NOISE - FIGURE 1

Hidden Hills Solar Electric Generating System (HHSEGS) - Noise Monitoring Locations



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SOURCE: HHSEG AFC, Figure 5.7-1, August 2011

NOISE